

Research on European stone fruit yellows (ESFY) in Germany

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Abstract

Since 2000, surveys have been conducted in different stone fruit growing regions in southwest Germany to detect European stone fruit yellows (ESFY) disease in Germany. Each year visual inspections for typical symptoms of ESFY have been done on different *Prunus* species. Branch samples of all trees with typical symptoms as well as randomized samples from trees with doubtful symptoms have been taken in summer and analysed for infection with 'Candidatus Phytoplasma prunorum'. The pathogen could be detected in the regions Rheinland, Rheinhessen, Vorder- and Südpfalz and Baden and was present in all cultivated *Prunus* species: *P. armeniaca*, *P. persica*, *P. domestica* and *P. amygdalus*. For apricots, more than 80% of the samples were infected while peach and European plum were less affected. Almost no infection was found in the wild *Prunus* species *P. spinosa* and *P. cerasifera*.

Regular psyllid captures on different *Prunus* species gave high populations of *Cacopsylla pruni* on *P. spinosa* and *P. cerasifera* while only few individuals were collected from cultivated orchards. The natural infection rate of field collected *C. pruni* was between 2 and 3%. Transmission trials under controlled conditions showed the capability of *C. pruni* to transmit the phytoplasma to healthy test plants and proved that *C. pruni* is also a vector of 'Ca. P. prunorum' in Germany.

Key words: 'Candidatus Phytoplasma prunorum', host plants, *Cacopsylla pruni*, transmission trials.

Introduction

All stone fruit species in the southern half of Europe are affected by severe decline diseases associated with phytoplasmas (Jarausch *et al.*, 1998). 'Candidatus Phytoplasma prunorum' (Seemüller and Schneider, 2004) is the causal agent of apricot chlorotic leaf roll and other decline diseases affecting trees of the genus *Prunus* (Lorenz *et al.*, 1994). Phytoplasmas have also been found on peach and almond (Poggi Pollini *et al.*, 1993; Lederer and Seemüller, 1992) and on wild *Prunus* species (Jarausch *et al.*, 2001; Carraro *et al.*, 2002). Typical symptoms are yellowing and leaf roll in summer and off-season growth in winter, die-back and a more or less rapid decline follow.

Carraro *et al.* (1998) identified the psyllid species *Cacopsylla pruni* (Scopoli) as vector for 'Ca. P. prunorum' in Italy and Jarausch *et al.* (2001) confirmed the vector capacity of this psyllid species in France. In Germany, the first detection of the agent in different *Prunus* has already been reported in 1992 by Lederer and Seemüller. But in the following years no further data on the disease were available for Germany.

Thus, a new research was started several years ago to collect more information about the pathogen and the presence of the potential vector *C. pruni* in order to estimate the actual spread of this disease in the most important stone fruit growing regions in southwest Germany.

Materials and methods

Since 2000, field observations have been conducted in five different regions in southwest Germany. Each year selected orchards of the cultivated *Prunus* spp. *P. armeniaca* (apricot), *P. persica* (peach), *P. domestica* (European plum) and *P. amygdalus* (almond) were surveyed for symptom expression in spring and autumn. Samples were taken from symptomatic trees and from a certain

number of trees without symptoms for detection of latent infection.

Insect captures have been done each year from March until July in selected orchards in Rheinhessen, Vorderpfalz and Südpfalz on *P. armeniaca*, *P. persica*, *P. amygdalus* and on the wild *Prunus* spp. *P. cerasifera* and *P. spinosa* (hawthorn), respectively. All specimens of *C. pruni* were separated from the mixed samples for DNA extraction and PCR analysis.

Total DNA from plant material was extracted from leaf petioles or branch phloem and total DNA from insects was extracted from single individuals of *C. pruni* using the method described by Maixner *et al.* (1995).

PCR detection was done with 'Ca. P. prunorum'-specific primers ECA1/ECA2 as published by Jarausch *et al.* (1998).

Transmission trials were carried out with overwintering adults of *C. pruni* from field captures in closed glass vessels under controlled conditions in the greenhouse using micropropagated GF-8.1 (*P. marianna*) as healthy test plants (Jarausch *et al.*, 1994). Larvae or young imagines from rearings on healthy plants were first put on infected plants for acquisition feeding and then transferred to healthy test plants for transmission. All insects were recollected and tested individually for the presence of 'Ca. P. prunorum' by PCR. The test plants were cultivated in the greenhouse under insect-proof conditions and analysed with PCR for infection with the pathogen 6, 12 and 18 months later.

Results and discussion

Since 2000, selected orchards in southwest Germany have been surveyed in order to assess the spread of ESFY disease in the most important stone fruit growing regions in Germany. The study showed that 'Ca. P. prunorum' was present in all regions with various infec-

tion rates in the different orchards and on the different *Prunus* species. Summarizing all PCR-positive samples from all regions, 64% of all samples were infected with the phytoplasma. *P. armeniaca* (apricot) was the most affected species in all investigated regions with more than 80% of infected samples while *P. domestica* (European plum) and *P. persica* (peach) were less affected. This result agrees with reports from other European countries (Desvignes and Cornaggia, 1982; Carraro *et al.*, 1998; Jarausch *et al.*, 1998).

Interestingly, the agent could not only be analysed in samples from symptomatic plants, but was also detected to an important percentage in non-symptomatic plants. Those latently infected trees represent an enlarged source of inoculum for insect vectors which acquire the pathogen and transmit it across the orchard.

As *C. pruni* has been identified as vector for 'Ca. P. prunorum' in many European countries (Carraro *et al.*, 1998; Jarausch *et al.*, 2001), we concentrated our research for the vector in Germany on this psyllid species. During the years of this study, *C. pruni* was found in all ESFY-infested orchards by the regular psyllid captures in 3 different fruit growing regions in southwest Germany. Wild *Prunus* species such as *P. cerasifera* or *P. spinosa* were the main host plants for *C. pruni* in Germany while population densities on cultivated *Prunus* species were always lower. This result fits with observations from other European countries (Carraro *et al.*, 2002; Yvon *et al.*, 2004). From the PCR analysis of each single *C. pruni*, we calculated a mean natural infection rate of about 2-3% during all years of investigation.

In order to verify the vector capacity of *C. pruni*, we conducted transmission trials under controlled conditions in the greenhouse with field collected overwintering adults and with larvae and young adults from rearings, respectively.

During this study, overwintering adults of *C. pruni* transmitted the phytoplasma to 23% of the test plants. Combined acquisition/transmission trials showed that both developmental states, larvae and young imagines, could acquire the agent from infected plants but in only 3 cases out of 83 passages we obtained a successful transmission to healthy test plants. However, from these results we can conclude that *C. pruni* is also a vector of 'Ca. P. prunorum' in Germany.

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